



◇ July 13, 1990 / 39(RR-10);7-20

Prevention and Control of Tuberculosis in Facilities Providing Long-Term Care to the Elderly Recommendations of the Advisory Committee for Elimination of Tuberculosis

These recommendations were developed by the Advisory Committee for Elimination of Tuberculosis, CDC staff, and public health consultants. They describe tuberculosis control activities appropriate for nursing homes and other facilities providing long-term care for elderly persons. Such facilities include long-term-care wings or units in hospitals, adult foster-care homes, board and care homes, and other congregate settings for the elderly (referred to hereafter as "facilities"). The recommendations are intended for use by staff and administrators of these facilities, consultants to these facilities, and regulatory and licensing bodies.

This document is not intended for use as a primer on tuberculosis. More general information about tuberculosis is available in the American Thoracic Society (ATS)/CDC statements referenced in this document. State and local health departments are encouraged to continue the search for new, innovative, and more effective approaches for controlling and preventing tuberculosis in facilities providing long-term care for the elderly. BACKGROUND

Persons greater than or equal to 65 years of age constitute a large repository of *Mycobacterium tuberculosis* infection in the United States. Tuberculosis case rates are higher for this age group than for any other. In 1987, the 6,150 tuberculosis cases reported for persons greater than or equal to 65 years of age accounted for 27% of the total U.S. tuberculosis morbidity, even though this age group represents only 12% of the U.S. population (1). The control and prevention of tuberculosis among the elderly must be addressed aggressively to achieve the goal of eliminating tuberculosis in the United States by the year 2010 (2).

CDC surveillance data indicate that, as with younger age groups, most elderly tuberculosis patients (84%) have pulmonary disease; because more than half of these patients have sputum smears positive for acid-fast bacilli, they are potentially capable of transmitting the infection to other persons (CDC, unpublished data).

In the United States, more elderly persons live in nursing homes than in any other type of residential institution; based on data from CDC's National Center for Health Statistics, approximately 5% of all elderly persons live in a nursing home (3). However, elderly persons represent 88% of the nation's approximately 1.7 million nursing home residents (3). Such concentrations of elderly persons, many of whom are infected with tubercle bacilli and some of whom are immunosuppressed, create high-risk situations for tuberculosis transmission.

Elderly nursing home residents are at greater risk for tuberculosis than elderly persons living in the community. In 1984-1985, a CDC-sponsored study of 15,379 routinely reported tuberculosis cases from 29 states indicated that the incidence of tuberculosis among nursing home residents was 39.2 cases per 100,000 population; in comparison, the incidence of tuberculosis among elderly persons living in the community was 21.5 cases per 100,000 population (CDC, unpublished data).

Nursing home employees are also at increased risk for tuberculosis when compared with other employed adults. In the CDC study, the observed case rate among nursing home employees was three times higher than the rate expected for employed adults of similar age, race, and sex (CDC, unpublished data).

Investigators have reported outbreaks in nursing homes in which transmission of tuberculosis was documented among residents and staff (4-8). The person having the source case has usually been a resident but may be a member of the staff. In such situations, isoniazid preventive therapy has effectively reduced the risk of tuberculosis among contacts of newly infected elderly persons (9,10).

The following recommendations for addressing the problem of tuberculosis in facilities providing long-term care to the elderly have been developed in response to requests from state and local tuberculosis control officials, representatives of nursing homes and other long-term-care facilities, physicians in academic and clinical practice, and representatives of regulatory and resource-providing agencies. **GENERAL GUIDELINES**

Each facility should assure that appropriate tuberculosis prevention and control measures are undertaken to protect residents and staff. In large facilities, an infection control committee will usually be responsible for operating the tuberculosis prevention and control program. In a system that has more than one facility providing long-term care to the elderly, a qualified person should oversee the control activities at all of the facilities. Responsibility for surveillance, containment, assessment, and education should be specified in this person's job description. --Surveillance refers to identifying and reporting all cases of tuberculosis in the facility and identifying all infected residents and staff. When an infectious case is identified, additional cases and new infections (as indicated by skin-test conversion) should be identified with the help of the state or local health department, and appropriate therapy should be instituted. --Containment refers to ensuring that transmission of tuberculous infection is stopped promptly. Persons for whom treatment of disease or preventive treatment is indicated should complete the appropriate course of treatment under direct supervision (i.e., the actual ingestion of

medication is observed by a staff member). In addition, appropriate ventilation control measures should be applied. --Assessment refers to monitoring and evaluating the surveillance and containment activities throughout each facility. --Education refers to providing information and imparting skills to patients, families, visitors, and employees so that they understand and cooperate with surveillance, containment, and assessment activities. SURVEILLANCE Diagnosis

The intracutaneous administration of 5 units of purified protein derivative tuberculin (PPD-T) (Mantoux test) should be used to identify persons infected with tubercle bacilli. Multiple-puncture devices are not recommended. False-negative reactions to the tuberculin test may occur for up to 30% of persons with tuberculosis but without acquired immunodeficiency syndrome (AIDS); in comparison, false-negative reactions may occur for up to 60% of persons with tuberculosis and AIDS (11; CDC, unpublished data). Therefore, a negative skin test does not exclude the diagnosis of tuberculosis. Chest radiography and bacteriologic examinations are indicated for all residents and staff with symptoms compatible with tuberculosis, regardless of the size of the skin-test reaction.

Skin tests should be administered to all new residents and employees as soon as their residency or employment begins unless they have documentation of a previous positive reaction. A two-step procedure is advisable for the initial testing of residents and employees in order to establish a reliable baseline (11-13). Appendix I explains this procedure and the rationale for using it. Each skin test should be administered and read by appropriately trained personnel and recorded (in mm induration) in the person's medical record. A record of all reactions of greater than or equal to 10 mm should be placed in a prominent location in order to facilitate the consideration of tuberculosis if the person develops signs or symptoms of tuberculosis, such as a cough of greater than 3 weeks' duration, unexplained weight loss, or unexplained fever. All persons with a reaction of greater than or equal to 10 mm should receive a chest radiograph to identify current or past disease.

Skin-test-negative employees and volunteers having contact (of greater than or equal to 10 hours per week) with elderly residents should periodically have repeat skin tests; the recommended frequency of repeat testing depends upon the risk of tuberculosis infection in that facility (13). Each tuberculin-positive resident should be evaluated annually, and a record should be kept that documents the presence or absence of symptoms of tuberculosis (e.g., weight loss, cough, fever). Repeat skin tests should be provided for tuberculin-negative residents and employees after any suspected exposure to a documented case of active tuberculosis. A skin-test conversion is defined as an increase of greater than or equal to 10 mm for a person less than 35 years of age or an increase of greater than or equal to 15 mm for a person greater than or equal to 35 years of age*.

Each skin-test converter should have a chest radiograph; if the radiograph is negative for tuberculosis, the individual should be treated preventively. If the source of infection is not known and/or if additional conversions occur, periodic retesting of residents and a careful search for the source case should be continued.

Persons with reactions greater than or equal to 10 mm and persons with symptoms suggesting tuberculosis (e.g., cough, anorexia, weight loss, fever), regardless of the size of the skin-test reaction, should have a chest radiograph within 72 hours. Persons with abnormal chest radiographs and/or symptoms compatible with tuberculosis should also have sputum smear and culture examinations. In addition, sputum should be submitted for smear and culture for acid-fast bacilli for persons with a chronic cough, pneumonia, or bronchitis who do not respond promptly and completely to antibiotic treatment. At least three sputum specimens should be submitted. In the absence of spontaneous production of sputum, suction of laryngeal or pharyngeal mucus is satisfactory if sterile water is used in clearing the catheter. Usually, the early detection of tuberculosis by such means either prevents or greatly diminishes the spread of infection.

Staff members who are considered to have infectious tuberculosis should be relieved of work responsibilities until the diagnosis is excluded or until they become noninfectious as a result of effective chemotherapy. Case Reporting

Whenever tuberculosis is suspected or confirmed among residents or staff, this information should be recorded and kept on file (in the medical record, personnel record, or other appropriate place). A prototype tuberculosis record is shown in Appendix II. The local or state health department should also be notified, as required by state and local laws or regulations. Tuberculosis and Human Immunodeficiency Virus Infection

Staff members and residents with tuberculosis or tuberculous infection should be assessed for human immunodeficiency virus (HIV) infection because the medical management of tuberculosis and tuberculous infection must be altered in the presence of HIV infection. Factors** that are associated with an increased risk or prevalence of HIV infection should be routinely sought. If HIV infection is considered a possibility, counseling and HIV-antibody testing should be strongly encouraged. Previously published guidelines provide additional information about this topic (14).

CONTAINMENT Isolation

Persons with suspected or confirmed tuberculosis can remain in their usual environment, provided 1) chemotherapy is promptly instituted at the time the diagnosis is suspected or confirmed, 2) recent and current contacts are evaluated and placed on appropriate therapy, and 3) new contacts can be prevented for a 1- to 2-week period. If these conditions cannot be met, the person with suspected or confirmed tuberculosis should be placed under appropriate isolation precautions to prevent the spread of infection (15). The local health department should be contacted regarding the need for isolation and the methods used for achieving it. Treatment

ATS/CDC recommendations should be followed in treating and managing persons with confirmed or suspected tuberculosis (14,16). For newly diagnosed, previously untreated patients, the treatment regimen should contain both isoniazid and rifampin. If the patient has been treated for tuberculosis in the past, other or additional drugs may be needed.

Antituberculosis medication should be given along with other medication administered by nursing home staff. Each dose of medication should be dispensed by a staff person who watches the patient swallow the pills and who is trained to monitor for evidence of drug toxicity. Persons with positive sputum smears or cultures at the beginning of therapy should be monitored by repeat sputum examinations for treatment response until smears become negative. Failure to achieve negative smears and cultures is usually due to the patient's noncompliance with therapy but may be due to the presence of drug-resistant organisms or other complications. Patients should also be monitored by trained personnel for signs and symptoms of adverse drug reactions during therapy (14,16). Expert medical consultation should be sought when treating patients with complications (e.g., drug resistance, adverse reactions, nonpulmonary tuberculosis). Such consultation is usually available through the local or state health department. Investigation for Contacts

Because tuberculosis is transmitted by the airborne route, persons who sleep, live, work, or who are otherwise in contact with an infectious person through a common ventilation system for a prolonged time are "close contacts" at risk of acquiring infection. These persons may include other residents, staff, and visitors. When a person with confirmed tuberculosis appears to be infectious (e.g., has pulmonary involvement as seen by chest radiograph and a cough and/or positive sputum smear), contacts who were previously tuberculin-negative should be retested (13). If the case occurs in a known tuberculin converter, a search for the person who has the source case (referred to hereafter as the "source patient") should be undertaken by performing chest radiographs for all persons known to be tuberculin reactors and by submitting sputum specimens for smear and culture for all patients with a cough.

General guidelines for conducting a contact investigation in a nursing home or other facility are given in Appendix III, but health department personnel should be consulted to help determine which contacts should be examined. Preventive Therapy

Contacts who have documented skin-test conversions and whose chest radiographs do not reveal tuberculosis should be given at least 6 months' preventive therapy unless it is medically contraindicated. Other residents and staff with positive tuberculin reactions should be given preventive therapy and monitored according to previously published guidelines (17).

Preventive therapy for residents should be incorporated into the facility's routine for delivering medications (e.g., blister pack, cardex file) and should be dispensed by a staff person trained to monitor for signs and symptoms of drug toxicity (16). If such signs or symptoms appear, medication should be withheld pending evaluation by a physician.

If tuberculosis preventive therapy is recommended, but individuals refuse or are unable to complete the recommended course, they should be advised to seek prompt medical attention if they develop signs or symptoms compatible with tuberculosis (e.g., persistent cough, anorexia, weight loss, night sweats). Routine periodic chest radiographs are not useful for detecting disease in the absence of symptoms; however, chest radiographs

should be obtained promptly for persons with a cough that persists for more than 3 weeks and/or with a prolonged and unexplained fever. **ASSESSMENT**

A record-keeping system, such as that shown in Appendix II, is essential for tracking and assessing the status of persons with tuberculosis and tuberculous infection in nursing homes/facilities that provide long-term care for elderly persons. This system should also provide data needed to assess the overall effectiveness of tuberculosis control efforts. The following information should be reviewed annually with health department staff and should be compared with previous data and data from other facilities in the area: --

Percentage of residents and staff within each facility with positive skin tests --Percentage of persons showing conversion of the tuberculin test if retesting is performed --

Description of therapy and supervision --Percentage of persons recommended for therapy who complete the prescribed course (goal is greater than 95%) --Number of persons experiencing drug toxicity or intolerance --Number of persons discontinuing medication and reason for discontinuance **ROLE OF THE HEALTH DEPARTMENT**

State and local health departments should assist in developing and updating policies, procedures, and record systems for tuberculosis control in nursing homes and other facilities that provide residential care for elderly persons. The health department should also provide access to expert tuberculosis medical consultation. A health department representative should be designated to provide epidemiologic and management assistance to such facilities, and this responsibility should be an element in that person's job performance plan. At a minimum, he or she should be required to complete an initial on-site consultation, to be available for telephone consultation, and to conduct an annual evaluation of individual facilities.

State health departments should assist local units in developing programs to train facility staff to administer, read, and record tuberculin skin tests; to identify signs and symptoms of tuberculosis; to initiate and observe therapy; to monitor for side effects; to collect diagnostic specimens; and to maintain record systems.

Health departments should also provide consultation for contact investigations within facilities, and they should assure appropriate examinations of nonresident contacts of persons with tuberculosis diagnosed in these facilities.

State health departments have a responsibility to maintain a tuberculosis registry with updated medical information on all persons who currently have tuberculosis within their jurisdiction, including persons in nursing homes and other facilities providing residential care for elderly persons. Records should be assessed annually, and necessary revisions in policies or procedures should be recommended. In addition, state health departments should periodically assess the impact of tuberculosis acquired in a residential facility and the impact of tuberculous infection on the community as a whole.

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- The Committee chose a larger increase in reaction size to

define a skin-test conversion among persons greater than or equal to 35 years of age because of the increased risk of isoniazid-associated hepatotoxicity in this age group.

With the use of this criterion, the benefits of using isoniazid preventive therapy should clearly outweigh its risks.

**** On the basis of seroprevalence studies, factors that place a person at risk for HIV infection include intravenous (IV)-drug use and homosexual/bisexual contact. Other factors that increase the risk for HIV infection among adults include having received blood or clotting-factor concentrate between 1978 and 1985 and having had sexual relations at any time since 1978 with 1) a person known to be infected with HIV or to have AIDS, 2) a man who has had homosexual/bisexual contact, 3) prostitutes, 4) IV-drug users, or (5) persons born in countries where most transmission of HIV is thought to occur through heterosexual sexual contact. Appendix I Detection of Newly Infected Persons (Skin-Test Converters)**

The tuberculin test can be especially valuable when it is repeated periodically in the surveillance of tuberculin-negative persons likely to be exposed to tuberculosis. However, special problems exist in identifying newly infected persons.

First, some errors may occur in even the most carefully performed tests. For this reason, small increases in reaction size are usually not meaningful. Only persons whose tuberculin reactions show marked increases in size (i.e., greater than or equal to 10 mm among persons less than 35 years of age and greater than or equal to 15 mm among those greater than or equal to 35 years) within a 2-year period should be considered newly infected.

A second problem in identifying newly infected persons is the "booster phenomenon." Repeated testing of uninfected persons does not sensitize them to tuberculin. However, delayed hypersensitivity to tuberculin, once it has been established by infection with any species of mycobacteria or by *Bacillus of Calmette and Guérin* (BCG) vaccination, may gradually wane over the years. When tested at this point, these persons may have negative reactions. The stimulus of this test may then boost or increase the size of the reaction to a subsequent test, sometimes causing an apparent conversion or development of sensitivity. Although the booster phenomenon may occur at any age, its importance increases with age.

When tuberculin skin testing of adults is to be repeated periodically, the use of two-step testing initially can reduce the likelihood that a boosted reaction will be interpreted as representing recent infection. If the reaction to the first test is negative, a second test should be given a week later. If the second test result remains below the cutting point for a positive test, the reaction is considered to be negative. If the reaction to the second test is positive, it probably represents a boosted reaction and not a new infection.

Multiple-puncture devices should not be used in tuberculin-testing surveillance programs designed to detect newly infected persons (such as in periodic testing programs for employees of hospitals and other institutions or in the evaluation of contacts). Appendix II Tuberculosis Summary Record

The Prototype Tuberculosis Summary Record is designed to update the tuberculosis status of each resident and employee in a facility. This record may be kept in a central location (e.g., in the infection control office) or may be kept in individual patient or staff medical records. The form should not replace the tuberculosis diagnostic and treatment information found in the medical records of persons with tuberculosis symptoms or of those persons receiving antituberculosis medications.

The form can also be used to prepare statistical reports and to track residents and employees requiring periodic skin testing. This information is important for assessing the overall effectiveness of tuberculosis control efforts in a facility. If kept current, the data on the forms can be summarized periodically and compared with previous data in order to determine: --The number of staff and residents having positive tuberculin skin tests --The number of persons whose tuberculin tests have shown conversions from negative to positive --The number of persons in the home receiving tuberculosis therapy and supervision --The number and percentage of persons recommended for therapy who complete the prescribed course (goal is greater than or equal to 95%)

When tuberculosis is diagnosed, the form contains the necessary information for reporting the case to the state or local health department. The form also reflects 1) if the case was reported, 2) if a contact investigation was completed, or 3) if HIV testing was performed. Summary information regarding the use of chemotherapy for infection or disease can also be recorded.

Many items on the form require only a check in the appropriate box. The format follows events in the order they are likely to occur in the diagnosis of tuberculosis infection and disease.

The first section can be completed at the time of admission or employment; it documents personal information, as well as baseline skin-testing results. Space is provided for recording the results of a second initial skin test when the two-step procedure is used.

If baseline skin testing is negative, the results of retesting can be recorded on the second section of the form.

The final section of the form can be used to document x-ray and bacteriologic results, diagnosis, chemotherapy, and other information. This part of the form is generally used only for those residents or employees who have tuberculous infection or disease, those who have tuberculosis symptoms, or those who require follow-up after exposure to tuberculosis. Appendix III Investigation for Contacts

Contacts of persons with newly diagnosed tuberculosis are at risk of infection and disease. The risk to contacts is related to various factors pertaining to the person who has the source case (the "source patient"), the contact, and the environment that they share. Many factors interact to influence the transmission of infectious particles (droplet nuclei) from the source patient to the contact.

As soon as the diagnosis is reasonably established on laboratory and/or clinical bases, investigation of contacts should begin. Health-care personnel should not wait for positive cultures if history, sputum smears, and chest radiographs are suggestive of tuberculosis.

A. Development of Transmission Probability Data

When a source patient has been identified, the appropriate procedure in contact investigation entails the development of a data base and an evaluation of each of the factors noted below. These data are usually gathered by interviewing the source patient and by reviewing related historic and laboratory records. A visit to the source patient's home or place of employment will usually be necessary to assemble a satisfactory initial data base.

Source-patient characteristics. Any person who is generating aerosolized particles containing tubercle bacilli is a potential transmitter of infection. Factors that indicate the probability of spreading tuberculous infection are:

- If the source patient is not receiving adequate antituberculosis chemotherapy, the probability of his or her producing infectious particles is enhanced.
- The presence of acid-fast bacilli in the appropriately examined sputum smear is indicative of a greater potential for infection.
- The ability to culture *Mycobacterium tuberculosis* from secretions of the source patient is less important quantitatively as an indicator than is the positive sputum smear.
- The presence of tuberculous laryngitis increases infectiousness.
- The presence of cough increases the probability of aerosol generation.
- The volume and viscosity of respiratory secretions influence the production of infectious particles; high volume and watery sputum are regarded as risk factors.
- Forceful exhalation (e.g., singing or shouting) may increase the potential for producing infectious particles.
- Prolonged duration of respiratory symptoms may augment the likelihood that infection will be transmitted.

Environmental air factors. Air is the vehicle by which the infectious particle or droplet nucleus is transported from the source patient to susceptible persons. The greater the concentration of these droplet nuclei in air shared by the source patient and his or her associates, the greater the risk to these contacts. The following factors alter the concentration of infectious particles in the air:

- The volume of air common to the source patient and contact is critical. If low, the concentration of infectious particles is increased (e.g., as in sharing a small room).
- Ventilation with outside air dilutes the concentration of potentially infectious droplets.
- Recirculating air may result in the accumulation of high concentrations of infectious particles because droplet nuclei remain suspended in the air (e.g., ships, hospitals, and other structures with closed-circuit heating and air-conditioning systems).
- Filtering air by high-efficiency particulate air (HEPA) filters removes the droplet nuclei from recirculated air.
- Ultraviolet irradiation of the upper air within the shared space (when feasible) may reduce the spread of infection by killing the tubercle bacilli suspended in the droplet nuclei.

Contact risk factors. Persons who have recently shared air with the source patient may be considered potentially infected contacts. The following factors are known to modify the risk of infection for these persons:

- Prior infection with tuberculosis, as indicated by a significant skin-test reaction before exposure to the identified source patient, reduces risk.
- Increased time in association with the source patient influences the probability of infection.
- Physical closeness between the source patient and the contact may influence the likelihood of infection.

B. Structuring a Contact Investigational Program

Establishment of investigational priorities. The estimated probability of transmission, based on information

obtained by following the steps described above, should influence the priority, rapidity, and thoroughness with which a contact investigation is conducted. By using this systematic approach, appropriate and productive public health programs can be implemented. Classification of contacts. For each source patient, the contact investigation should proceed in an orderly manner, starting with persons who are most likely to have been infected. Members of the immediate family or others who have shared accommodations with the source patient in the recent past usually are labeled household contacts. Contacts in working, leisure, or other settings are designated by other terms such as "close," "intimate," or "casual." The most important consideration in a contact investigation is the probability of infection among contacts; therefore, the first step is to allocate contacts into higher- and lower-risk contacts.

A higher-risk contact is defined as any person who shared the environment air with a source patient for a relatively longer time and who has other risk factors relatively higher than those of other known contacts. Nursing home/facility residents sharing the same wing or ventilation circuit should usually be considered close contacts. C. Establishing Limits for Contact Investigations

By initially evaluating the higher-risk contacts for evidence of tuberculous infection and/or disease, the actual infectiousness of the source patient can be inferred. The following are guidelines for limiting the extent of a contact investigation: --Initiate investigation with higher-risk contacts; if there is no evidence of recent transmission of infection in this group, extending the investigation is not appropriate. --If data indicate recent infection in the higher-risk group, extend the limits of investigation to progressively lower-risk contacts until the levels of infection detected approximate the levels of infection in the local community. --At each stage of the investigation, establish the number and identity of contacts to be examined. Establishing such a denominator helps to assure that no contact who should be examined is missed.

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